UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/770,395	02/04/2004	Ari Hottinen	60091.00269	2744

32294 7590 12/10/2007
SQUIRE, SANDERS & DEMPSEY L.L.P.
14TH FLOOR
8000 TOWERS CRESCENT
TYSONS CORNER, VA 22182

EXAMINER	
HUANG, DAVID S	
ART UNIT	**PAPER NUMBER**
2611	
MAIL DATE	**DELIVERY MODE**
12/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/770,395	HOTTINEN ET AL.	
	Examiner	Art Unit	
	David Huang	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 September 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's arguments, with respect to the abstract have been fully considered and are persuasive. The objection has been withdrawn.

2. Applicant's arguments, with respect to **claims 4-6** have been fully considered and are persuasive. The objection has been withdrawn.

3. Applicant's arguments with respect to **claims 1, 7-8, 11, and 12** have been fully considered but they are not persuasive.

Applicant's argument: Tirkkonen is not a proper reference to reject claims 1, 7-8, 11, and 12 under 35 USC 103(a). Specifically, Tirkkonen is not a proper reference to reject the aforementioned claims under 35 USC 103(a) because Tirkkonen fails to satisfy the requirements of 35 USC 102. Tirkkonen has a publication data of January 3, 2003... In contrast, the present application has a priority date of November 17, 2003, for which the claim of foreign priority under 35 USC 119(a)-(d) was filed on February 2, 2004... Tirkkonen fails to satisfy the requirements of any section of 35 USC 102. Specifically, since the inventors are the same, the reference is not "by another" as required by 102(e) or "by others" as required by 102(a).

Examiner's response: Tirkkonen qualifies as prior art under 35 USC 102(b) since it was published in this or a foreign country more than a year prior to the filing date of the present application. The 1-year time bar is measured from the U.S. filing date. Therefore, the Tirkkonen is a proper reference to reject the aforementioned claims under 35 USC 103(a). See MPEP 2133.

Therefore, Tirkkonen properly teaches the "using, when constructing the channel symbols, at least a first non-zero coefficient and a second non-zero coefficient in at least one layer when performing a linear combination, wherein the ratio of the first coefficient and the

second coefficient is not a real number" limitation as presented in claim 1 below and properly establishes a prima facie case of obviousness with respect to claims 1, 7, 8, 11, and 12.

Applicant's arguments regarding the dependent claims relies upon the erroneous presumption that Tirkkonen is not a proper reference and do not teach the limitation presented above. However, since Tirkkonen is a proper reference which teaches the cited limitation, the rejections applied to the dependent claims are proper and complete.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. **Claim 15** is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 15 recites "wherein the transmission power ratio between symbols transmitted at different times within a layer is 0.38 when rounded to two decimals," but the specification lacks any description of such limitation. There is a discussion of the power disparity of 20% and 80% on page 18, [0086], but this discussion does not describe a ratio of 0.38 as claimed.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1, 7-8, 11 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (US Patent Application Publication 2002/0154705) in view of Tirkkonen et al. (PCT Application Publication WO 03/001728).

Regarding **claim 1**, Walton et al. discloses a transmission method comprising:

constructing layered channel symbols as linear combinations (In MIMO processing mode, each modulation symbol in the sub-channel represents a linear combination of modulation symbols, page 9, [0101]) of complex modulation symbols (bits grouped into modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM, page 9, [0101], where it is understood that PSK and QAM symbols are complex modulation symbols); and

transmitting the channel symbols via at least two transmit paths (RF modulated signals from modulators 114*a* through 114*t* are then transmitted from respective antennas 116*a* through 116*t* over communication links 118, page 3, [0032], Figure 1);

using, for at least one modulation symbol, a first non-zero total power for transmission on a first transmit path of the at least two transmit paths, and a second non-zero total power for transmission on a second transmit path of the at least two transmit paths, wherein the first and second total powers are not equal (when operating in diversity communications mode, if the pass loss from a particular antenna is great, transmission from this antenna can be reduced. Similarly, if transmission occurs over multiple sub-channels, less power may be transmitted on the sub-channel(s) experience the most path loss, page 13, [0137]).

However, Walton et al. fail to expressly disclose wherein using, when constructing the channel symbols, at least a first non-zero coefficient and a second non-zero coefficient in at least one layer when performing a linear combination, wherein the ratio of the first coefficient and the second coefficient is not a real number.

Tirkkonen et al. disclose the modulations symbols are subjected to complex diversity transform, wherein the symbol sequences are replaced, using complex diversity transform with super symbol sequences (page 16, lines 18-25). In an example, Tirkkonen et al. disclose the complex diversity transform is preferable implemented by s3, s4 being a unitary linear combination of QPSK symbols $\hat{s}3, \hat{s}4$. The channel symbol $s1 + s3 = s1 + \mu\hat{s}3 + \nu\hat{s}4$ is transmitted from the first antenna and the optimum values for coefficients μ, ν are complex values (page 13, lines 9-29). Therefore, the ratio between the optimum μ and ν is not a real number (imaginary).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Walton et al. with the complex diversity transform taught by Tirkkonen et al. since the super symbol sequences generated by the complex diversity transform endure fading and interference on the transmission path and decrease the effect of inter-symbol sequence interference on the detection of the symbol sequences (page 16, lines 24-28).

Regarding **claim 7**, Walton et al. disclose a transmitter comprising:

antenna means for achieving two transmit paths for transmission of a signal (RF modulated signals from modulators 114a through 114t are then transmitted from respective antennas 116a through 116t over communications links 118 to system 120, page 3, [0032]; Figure 1);

means for modulating (Data processor 320 thus receives and processes the encoded data corresponding to K channel data streams to provide NT modulation symbol vectors, V_1 through V_{NT}, one modulation symbol vector for each transmit antenna, page 9, [0104], Figure 3) the signal to be transmitted into complex modulation symbols (bits grouped into modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM, page 9, [0101], where it is understood that PSK and QAM symbols are complex);

means for constructing layered channel symbols (Data processor 320 thus receives and processes the encoded data corresponding to K channel data streams to provide NT modulation symbol vectors, V_1 through V_{NT}, one modulation symbol vector for each transmit antenna, page 9, [0104], Figure 3) as linear combinations of the complex modulation symbols (In the MIMO processing mode, each modulation symbol in the sub-channel represents a linear combination of modulation symbols, page 9, [0101]); and

means for (power control can be achieved with a feedback mechanism similar to that used in the CDMA system, page 13, [0138]) transmitting the channel symbols by using, for at least one modulation symbol, a first non-zero total power for transmission on a first transmit path, and a second non-zero total power for transmission on a second transmit path, wherein the first and second total powers are not equal (when operating in diversity communications mode, if the pass loss from a particular antenna is great, transmission from this antenna can be reduced. Similarly, if transmission occurs over multiple sub-channels, less power may be transmitted on the sub-channel(s) experience the most path loss, page 13, [0137]).

However Walton et al. fail to expressly disclose means for constructing channel symbols by using at least a first non-zero coefficient and a second non-zero coefficient in at least one

layer when performing the linear combinations, wherein the ratio of the first and second coefficient is not a real number.

Tirkkonen et al. disclose the modulations symbols are first applied to transform means 304 in which the symbols are subjected to complex diversity transform, wherein the symbol sequences are replaced, using complex diversity transform with super symbol sequences (page 16, lines 18-25). In an example, Tirkkonen et al. disclose the complex diversity transform is preferable implemented by s3, s4 being a unitary linear combination of QPSK symbols $\hat{s}3, \hat{s}4$. The channel symbol $s1 + s3 = s1 + \mu\hat{s}3 + \nu\hat{s}4$ is transmitted from the first antenna and the optimum values for coefficients μ, ν are complex values (page 13, lines 9-29). Therefore, the ratio between the optimum μ and ν is not a real number (imaginary).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide Walton et al. with the transform means 304 taught by Tirkkonen et al. since the super symbol sequences generated by the complex diversity transform endure fading and interference on the transmission path and decrease the effect of inter-symbol sequence interference on the detection of the symbol sequences (page 16, lines 24-28).

Regarding **claims 8, 11 and 12**, Walton et al. disclose a transmitter, implemented in either a base station or terminal equipment of a cellular radio system (page 3, [0036], Figure 1), comprising:

an antenna system for achieving two transmit paths for transmission of a signal (RF modulated signals from modulators 114a through 114t are then transmitted from respective antennas 116a through 116t over communications links 118 to system 120, page 3, [0032], and Figure 1);

a first modulator for modulating (Data processor 320 thus receives and processes the encoded data corresponding to K channel data streams to provide NT modulation symbol vectors, V_1 through V_{NT}, one modulation symbol vector for each transmit antenna, page 9, [0104], Figure 3) the signal to be transmitted into complex modulation symbols (bits grouped into modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM, page 9, [0101], where it is understood that PSK and QAM symbols are complex);

a second modulator for constructing layered channel symbols (Data processor 320 thus receives and processes the encoded data corresponding to K channel data streams to provide NT modulation symbol vectors, V_1 through V_{NT}, one modulation symbol vector for each transmit antenna, page 9, [0104], Figure 3) as linear combinations of the complex modulation symbols (In the MIMO processing mode, each modulation symbol in the sub-channel represents a linear combination of modulation symbols, page 9, [0101]); and

the second modulator (Data processor 320, figure 3) and the antenna system (116a – 116t, Figure 1) are configured to transmit the channel symbols by using, for at least one modulation symbol, a first non-zero total power for transmission on a first transmit path, and a second non-zero total power for transmission on a second transmit path, wherein the first and second total powers are not equal (power control can be performed on each channel data stream, on each sub-channel, and on each antenna. When operating in the diversity communications mode, if the path loss from a particular antenna is great, transmission from this antenna can be reduced since little may be gained at the receiver unit. Similarly, if transmission occurs over multiple sub-channels, less power may be transmitted on the sub-channel(s) experiencing the most path loss, page 13, [0137]).

However, Walton et al. fail to expressly disclose wherein the second modulator is configured to construct the channel symbols by using at least a first non-zero coefficient and a second non-zero coefficient in at least one layer when performing the linear combination, wherein the ratio of the first and second coefficient is not a real number.

Tirkkonen et al. disclose the modulations symbols are first applied to transform means 304 in which the symbols are subjected to complex diversity transform, wherein the symbol sequences are replaced, using complex diversity transform with super symbol sequences (page 16, lines 18-25). In an example, Tirkkonen et al. disclose the complex diversity transform is preferable implemented by s3, s4 being a unitary linear combination of QPSK symbols $\hat{s}3, \hat{s}4$. The channel symbol $s1 + s3 = s1 + \mu\hat{s}3 + \nu\hat{s}4$ is transmitted from the first antenna and the optimum values for coefficients μ, ν are complex values (page 13, lines 9-29). Therefore, the ratio between the optimum μ and ν is not a real number (imaginary).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide Walton et al. with the transform means 304 taught by Tirkkonen et al. since the super symbol sequences generated by the complex diversity transform endure fading and interference on the transmission path and decrease the effect of inter-symbol sequence interference on the detection of the symbol sequences (page 16, lines 24-28).

3. **Claims 2, 9, and 13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (US Patent Application Publication 2002/0154705) in view of Tirkkonen et al. (PCT Application Publication WO 03/001728) as applied to *claims 1, 7, and 8* above, and further in view of Sampath (US Patent Application Publication 2003/0043929).

Regarding **claims 2, 9, and 13**, the combination of Walton et al. and Tirkkonen et al. discloses everything claimed as applied above (see *claims 1, 7, and 8*), but fails to expressly disclose the step and associated transmitter means for using at least one complex precoder matrix that comprises at least two non-zero elements that have different transmission powers.

Sampath teaches a preprocessor can also scale input symbol streams, depending upon system implementation issues that will be explained below. For example, in the case of scaling matrix dependence upon a BER/SR requirement at the receiver, if a first symbol stream requires a lower BER than a second symbol stream, then the preprocessor must allocate more power to the first stream (that is, scales it higher) and less power to the second stream (that is, scales it lower). If a first symbol stream includes a higher transmission order (higher order QAM) than a second symbol stream, the preprocessor can allocate more power to the first stream and less power to the second stream (page 5, [0066]-[0069]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the combination of Walton et al. and Tirkkonen et al. with the preprocessor taught by Sampath since it would allocate more power to symbol streams including higher transmission orders thereby improving symbol reception.

4. **Claims 3, 10, 14, and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (US Patent Application Publication 2002/0154705) in view of Tirkkonen et al. (PCT Application Publication WO 03/001728) as applied to *claims 1,7, and 8* above, and further in view of Lott et al. (US Patent Application Publication 2004/0120287).

Regarding **claims 3, 10, and 14**, the combination of Walton et al. and Tirkkonen et al. discloses everything claimed as applied above (see claims *1, 7, and 8*), but fails to expressly

disclose the step and associated transmitter means for using at least one real precoder matrix, wherein a transmission power ratio between symbols transmitted at different times within a layer is at least 2/8.

However, Walton et al. disclose that in MIMO processing mode, each modulation symbol in the sub-channel represents a linear combination of modulation symbols and bits are grouped into modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM, page 9, [0101], where it is common knowledge that BPSK symbols carry 1-bit of information, while 16-QAM symbols carry 4-bits of information.

Sampath teaches a preprocessor can also scale input symbol streams, depending upon system implementation issues that will be explained below. For example, in the case of scaling matrix dependence upon a BER/SR requirement at the receiver, if a first symbol stream requires a lower BER than a second symbol stream, then the preprocessor must allocate more power to the first stream (that is, scales it higher) and less power to the second stream (that is, scales it lower). If a first symbol stream includes a higher transmission order (higher order QAM) than a second symbol stream, the preprocessor can allocate more power to the first stream and less power to the second stream (page 5, [0066]-[0069]).

It is also known in the art that since power required to transmit data is roughly proportional to the data rate, increasing the data rate would also increase transmission power, as evidenced by Lott et al. (page 4, [0042]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the combination of Walton et al. and Tirkkonen et al. with the preprocessor taught by Sampath since it would adaptively allocate more power to symbol

streams including symbols with higher order modulations, thereby improving symbol reception. It would also have been obvious to one of ordinary skill in the art at the time was made to specify the power ratio to be 2/8 or ¼ since sub-channel modulation symbols are a linear combination of complex modulation symbols including BPSK and 16-QAM which carry 1 and 4 bits of information, respectively, and the transmission power is proportional to the data rate.

Regarding **claim 15**, the combination of Walton et al. and Tirkkonen et al. discloses everything claimed as applied above (see claim 1), but fails to expressly disclose the step of using at least one real precoder matrix, wherein a transmission power ratio between symbols transmitted at different times within a layer is .38 when rounded to two decimals.

However, Walton et al. disclose that in MIMO processing mode, each modulation symbol in the sub-channel represents a linear combination of modulation symbols and bits are grouped into modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM, page 9, [0101], where it is common knowledge that 8-PSK symbols carry 3 bits of information, while 256-QAM symbols carry 8-bits of information.

Sampath teaches a preprocessor can also scale input symbol streams, depending upon system implementation issues that will be explained below. For example, in the case of scaling matrix dependence upon a BER/SR requirement at the receiver, if a first symbol stream requires a lower BER than a second symbol stream, then the preprocessor must allocate more power to the first stream (that is, scales it higher) and less power to the second stream (that is, scales it lower). If a first symbol stream includes a higher transmission order (higher order QAM) than a second symbol stream, the preprocessor can allocate more power to the first stream and less power to the second stream (page 5, [0066]-[0069]).

It is also known in the art that since power required to transmit data is roughly proportional to the data rate, increasing the data rate would also increase transmission power, as evidenced by Lott et al. (page 4, [0042]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the combination of Walton et al. and Tirkkonen et al. with the preprocessor taught by Sampath since it would adaptively allocate more power to symbol streams including symbols with higher order modulations, thereby improving symbol reception. It would also have been obvious to one of ordinary skill in the art at the time was made to specify the power ratio to be 3/8 or .37 (or .38 when rounded to 2 decimals) since sub-channel modulation symbols are a linear combination of complex modulation symbols including 8-PSK and 256-QAM which carry 3 and 8 bits of information, respectively, and the transmission power is proportional to the data rate.

5. **Claims 4-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (US Patent Application Publication 2002/0154705) in view of Tirkkonen et al. (PCT Application Publication WO 03/001728) as applied to claim 1 above, and further in view of Brailean et al (US Patent 6,002,715).

Regarding **claim 4**, Walton et al. disclose everything claimed as applied above (see *claim 1*), but fail to expressly disclose transmitting the channel symbols via at least two transmit paths at different times, wherein the channel symbols transmitted using different transmit paths and different times form equidistant quadrature amplitude modulation constellations.

Nevertheless, Walton et al. teach symbols in the sub-channel represent linear combinations of modulation symbols using a particular modulation scheme e.g., M-PSK or M-

QAM (page 9, [0101]). Thus, it is implicit in Walton et al.'s disclosure that the sub-channel symbols consist of linear combinations of QAM modulation symbols. Walton et al. also teaches the modulation symbol to be transmitted at each time slot, on each sub-channel, can be individually and independently selected. This feature allows for the best use of the available resource over all three dimensions-time, frequency, and space (page 10, [0108]).

It is also well known in the art that 16 QAM constellation can be arranged in three groups such that, within any group, each symbol is equidistant from the origin, as is evidenced by Brailean et al. (column 2, line 63 – column 3, line 11; see table 1). In other words, the 16 QAM constellation consists of three groups of equidistant QAM constellations.

Therefore it would have been obvious to one of ordinary skill in the art, at the time the invention was made to modify Walton et al. so that the transmitted sub-channel symbols form equidistant QAM constellations because the use of 16 QAM as the specified modulation scheme is an engineering expedient suggested by Walton et al., and also because 16 QAM is well known in the art to consist of 3 groups of equidistant QAM constellations.

Regarding **claim 5**, Walton et al. disclose everything claimed as applied above (see *claim 1*), but fail to expressly disclose transmitting the channel symbols via at least two transmit paths at different times, wherein the channel symbols transmitted using different transmit paths and different times form a lattice.

Nevertheless, Walton et al. teach symbols in the sub-channel represent linear combinations of modulation symbols using a particular modulation scheme e.g., M-PSK or M-QAM (page 9, [0101]). Thus, it is implicit in Walton et al.'s disclosure that the sub-channel

symbols consist of linear combinations of QAM modulation symbols. Walton et al. also teaches the modulation symbol to be transmitted at each time slot, on each sub-channel, can be individually and independently selected. This feature allows for the best use of the available resource over all three dimensions-time, frequency, and space (page 10, [0108]).

It is also well known in the art that 4-QAM forms a constellation in which each symbol is equidistant from the origin, as is evidenced by Brailean et al. (core symbols, column 3, lines 34-37; see table 1).

Further, "lattice" is defined as a regular geometrical arrangement of points or objects over an area or in space (Merriam-Webster's Medical Dictionary, 2002).

Therefore it would have been obvious to one of ordinary skill in the art, at the time the invention was made to modify Walton et al. so that the transmitted sub-channel symbols form a lattice because the use of QAM as the specified modulation scheme is an engineering expedient suggested by Walton et al., and also because 4-QAM forms an equidistant constellation, and therefore a lattice.

Regarding **claim 6**, the combination of Walton et al. as evidenced by Brailean et al. disclose everything claimed as applied above (see *claim 5*), and further disclose wherein the lattice is equidistant (4-QAM constellation is equidistant).

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Huang whose telephone number is (571) 270-1798. The examiner can normally be reached on Monday - Friday, 8:00 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on (571) 272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DSH/dsh
December 5, 2007

Shuwang Liu

SHUWANG LIU
SUPERVISORY PATENT EXAMINER